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Docket No. F-8488

Ser. No. 10/517,895

AMENDMENTS TO THE CLAIMS:

Please replace the claims with the claims provided in the listing below wherein status, amendments, additions and cancellations are indicated.

1. (Canceled)

2. (Canceled)

3. (Currently Amended) A rolling bearing apparatus, comprising:

a rolling element formed as an inner ring of a bearing;

a non-rolling element disposed concentrically with said rolling element;

a rotation detector for outputting an induced voltage produced by an input exciting voltage according to a relative rolling state of said rolling element and said non-rolling element;

said rotation detector comprising:

a rotor provided [[in]] as part of said rolling elementinner ring;a stator provided [[in]] on said non-rolling element;

and

an exciting winding and output windings wound to

said stator, wherein

Docket No. F-8488

Ser. No. 10/517,895

said output windings induce a voltage according to
a gap permeance between said rotor and said stator in
response to said exciting voltage inputted to said exciting
winding; ~~[[and]]~~

said stator ~~being formed with~~ including a plurality of polar teeth ~~provided~~
~~in a surface of said non-rolling element which opposes~~ opposing said rolling
element ~~[[while]]~~ , and said exciting winding and output windings ~~[[are]]~~ being
wound to each of said polar ~~[[tooth]]~~ teeth of said stator, and

said rotor comprising a flat portion ~~[[formed]]~~ on a ~~circumference of the~~
portion of a circumferential surface ~~[[in]]~~ of said rolling element inner ring which
opposes said plurality of polar teeth ~~provided in said non-rolling element and is an~~
outer peripheral shoulder of said inner ring.

4. (Cancelled)

5. (Currently Amended) A rolling bearing apparatus, comprising:

a rolling element;

a non-rolling element disposed concentrically with said rolling element;

Docket No. F-8488

Ser. No. 10/517,895

a rotation detector for outputting an induced voltage produced by an input exciting voltage according to a relative rolling state of said rolling element and said non-rolling element;

said rotation detector comprising:

a rotor provided ~~[[in]]~~ on said rolling element;

a stator provided ~~[[in]]~~ on said non-rolling element;

and

an exciting winding and output windings wound to said stator, wherein

said output windings induce a voltage according to a gap permeance between said rotor and said stator in response to said exciting voltage inputted to said exciting winding;

said rolling element being made up of two inner rings disposed adjacent to each other in an axial direction and each having an inner ring raceway groove;

said rotor being provided at an area whereat outer peripheral annular surface ~~[[of]]~~ areas of said two inner rings oppose each other in the axial direction;

said non-rolling element being an outer ring disposed concentrically with said two inner rings in an outward-radial direction;

said outer ring having two outer ring raceway grooves in an inner peripheral

Docket No. F-8488

Ser. No. 10/517,895

surface thereof, said two outer ring raceway grooves being separated away from each other in an axial direction and opposing respective ones of said inner ring raceway grooves of said two inner rings; [[and]]

said stator being provided in a region between said outer ring raceway grooves of said outer ring;

said rotor having first and second inner circumferential surfaces disposed adjacent each other in the axial direction;

said inner rings respectively having inner ring outer circumferential surface end portions adjacent one another in the axial direction;

said rotor being fixed by fixedly fitting said first inner circumferential surface onto the inner ring outer circumferential surface end portion of one of said inner rings; and

said second inner circumferential surface having a greater diameter than said inner ring outer circumferential surface end portion of another one of said inner rings and being disposed opposing said inner ring outer circumferential surface end portion of said another one of said inner rings and out of contact with said inner ring outer circumferential surface end portion of said another one of said inner rings such that said rotor does not contact said another one of said inner rings.

6. (Cancelled)

Docket No. F-8488

Ser. No. 10/517,895

7. (Original) The rolling bearing apparatus according to claim 5, wherein said exciting winding and said output windings are lead out from a through-hole provided in an area on a center of a circumference of said outer ring in an axial direction.

8. (Currently Amended) The rolling bearing apparatus according to claim 3, comprising:

a rolling element;

a non-rolling element disposed concentrically with said rolling element;

a rotation detector for outputting an induced voltage produced by an input exciting voltage according to a relative rolling state of said rolling element and said non-rolling element;

said rotation detector comprising:

a rotor provided on said rolling element;

a stator provided on said non-rolling element; and

an exciting winding and output windings wound to

said stator, wherein

said output windings induce a voltage according to

a gap permeance between said rotor and said stator in

response to said exciting voltage inputted to said exciting

winding; and

Docket No. F-8488

Ser. No. 10/517,895

said stator including a plurality of polar teeth opposing said rolling element, and said exciting winding and output windings being wound to each of said polar teeth of said stator;

wherein said rolling element comprises:

a hub wheel; and

an inner [[rings]] ring fitted [[in]] on an outer periphery of

said hub wheel; and

said rotor being a nut mounted on one end side of said hub wheel in an axial direction for connecting so as to secure said inner [[rings]] ring to said hub wheel, wherein said nut serves as said rotor includes a flat portion which opposes said plurality of polar teeth.

9. (Currently Amended) The rolling bearing apparatus according to claim [[3]] 8, wherein said rolling element comprises:

[[a]] said hub wheel has first and second axial ends, [[with]] said hub wheel has, in sequential order from said first axial end, a flange provided in an outer periphery closer to an proximate said first axial end of one spindle in an outward-radial direction while having an outer peripheral surface with a small diameter in an outer peripheral surface on an end of vehicle inner side, a ring seat surface having a ring seat diameter, and a threaded portion having an outer thread diameter less than said ring seat diameter;

Docket No. F-8488

Scr. No. 10/517,895

~~[[an]]~~ said inner ring is ~~mounted outside the small-diameter outer peripheral surface of said hub wheel~~ on said ring seat surface;

said threaded portion is at said second axial end ~~a nut spindle portion formed on the vehicle inner end~~ of said hub wheel; and

said [[a]] nut helically mounted is mounted to said hub wheel by being threaded on said nut spindle threaded portion, said rotor being formed of said nut;

said non-rolling element is an outer ring disposed ~~on an outer periphery side~~ of concentrically about said hub wheel;

a cap is mounted in ~~a vehicle inner side~~ an opening of said outer ring; and

said stator is fixed to an inner periphery of said cap and said stator opposes said nut in a radial direction.

10. (Currently Amended) A rolling bearing apparatus, comprising:

a rolling element;

a non-rolling element disposed concentrically with said rolling element;

a rotation detector for outputting an induced voltage produced by an input exciting voltage according to a relative rolling state of said rolling element and said non-rolling element;

said rotation detector comprising:

a rotor provided ~~[[in]]~~ on said rolling element;

a stator provided ~~[[in]]~~ on said non-rolling element;

Docket No. F-8488

Ser. No. 10/517,895

and

an exciting winding and output windings wound to
said stator, wherein

said output windings induce a voltage according to
a gap permeance between said rotor and said stator in
response to said exciting voltage inputted to said exciting
winding;

said rolling element comprising:

a hub wheel having first and second axial ends,
[[with]] said hub wheel having in sequential order from said
first axial end a flange provided in an outer periphery closer
to an proximate said first end, of one spindle in an outward-
radial direction while having outer peripheral surfaces with
a large diameter and a small diameter in an outer peripheral
surface on an end of vehicle inner side an intermediate
circumferential surface having a first diameter, a ring seat
surface having a ring seat diameter less than said first
diameter, and a threaded portion having an outer thread
diameter less than said ring seat diameter ; and

Docket No. F-8488

Ser. No. 10/517,895

~~an inner [[rings]] ring mounted outside the small-~~
~~diameter outer peripheral surface of said hub wheel on said~~
ring seat surface;

said non-rolling element being an outer ring disposed on an outer periphery
of said hub wheel;

said stator being mounted in ~~[[a]]~~ an axially center region of an inner
~~peripheral circumferential~~ surface of said outer ring ~~in an axial direction;~~ and

said rotor being formed by notches at least one notch provided ~~[[in]]~~ at a
~~plurality of areas an area on an circumference of a large-diameter outer peripheral~~
~~surface with a large diameter of said hub wheel, which opposes said stator in a~~
~~radial direction~~ said intermediate circumferential surface of said hub wheel.

11. (Currently Amended) A rolling bearing apparatus, comprising:

a rolling element;

a non-rolling element disposed concentrically with said rolling element;

a rotation detector for outputting an induced voltage produced by an input
exciting voltage according to a relative rolling state of said rolling element and said
non-rolling element;

said rotation detector comprising:

a rotor provided ~~[[in]]~~ on said rolling element;

a stator provided ~~[[in]]~~ on said non-rolling element;

Docket No. F-8488

Ser. No. 10/517,895

and

an exciting winding and output windings wound to
said stator, wherein

said output windings induce a voltage according to
a gap permance between said rotor and said stator in
response to said exciting voltage inputted to said exciting
winding;

said rolling element comprising:

a hub wheel having first and second axial ends,
[[with]] said hub wheel having in sequential order from said
first axial end a flange provided in an outer periphery closer
to an proximate said first end of one spindle in an outward-
radial direction while having outer peripheral surfaces with
a large diameter and a small diameter in an outer peripheral
surface on an end of vehicle inner side , an outer raceway
portion with first outer raceway groove having first outer
raceway groove diameter, an intermediate circumferential
surface having a first diameter, a ring seat surface having a
ring seat diameter less than said first diameter, and a

Docket No. F-8488

Ser. No. 10/517,895

threaded portion having an outer thread diameter less than
said ring seat diameter and having an inner ring raceway
groove in said large diameter outer peripheral surface; and
an inner [[rings]] ring mounted outside said small-
diameter outer peripheral surface of said hub wheel on said
ring seat surface and having a second inner raceway groove
having a second inner raceway groove diameter less than
said first inner raceway groove diameter;

said non-rolling element being an outer ring disposed concentrically with
 said ~~two inner rings in an outward radial direction while~~ hub wheel and having
~~[[two]]~~ first and second inner raceway grooves in an inner peripheral
circumferential surface being separated away from each other in an axial direction
respectively opposing each raceway groove of said first and second inner raceway
grooves ~~two inner rings;~~

~~— a vehicle outer side raceway groove of said outer ring being made to have~~
~~a larger diameter than that of a vehicle inner side raceway groove, the inner ring~~
~~raceway groove of said hub wheel is made to have a larger diameter than that of the~~
~~raceway groove of said inner ring;~~

~~— a PCD of said vehicle outer side ball group, among two groups of the~~
~~vehicle inner side and vehicle outer side mounted in between said each raceway~~

Docket No. F-8488

Ser. No. 10/517,895

~~groove, being made to have a larger diameter than that of PCB of a vehicle inner side ball group;~~

a first set of balls disposed in said first inner and outer raceway grooves and having a first pitch circle diameter, a second set of balls disposed in said second inner and outer raceway grooves and having a second pitch circle diameter less than said first pitch circle diameter;

said stator being mounted in ~~[[a]]~~ an axially center ~~center~~ region of an inner peripheral circumferential surface of said outer ring ~~in an axial direction; and~~

said rotor being formed by notches provided ~~[[in]]~~ at a plurality of areas on ~~an circumference of an outer peripheral surface region in an outer peripheral surface of said hub wheel, which opposes said stator in a radial direction~~ said intermediate circumferential surface.

12. (Currently Amended) A rolling bearing apparatus, comprising

a rolling element in the form of an inner bearing ring;

a non-rolling element disposed concentrically with said rolling element, said non-rolling element being in the form of an outer bearing ring;

a rotation detector for outputting an induced voltage produced by an input exciting voltage according to a relative rolling state of said rolling element and said non-rolling element; and

a generator for generating a voltage ~~in accordance with~~ using energy

Docket No. F-8488

Scr. No. 10/517,895

provided by relative rotation of said rolling element relative to said non-rolling element and inputting the voltage as an input exciting voltage to said rotation detector, said generator having a first portion mounted to said inner bearing ring and a second portion mounted to said outer bearing ring.

13. (Currently Amended) The rolling bearing apparatus according to claim 12, wherein said generator comprises:

a generating rotor provided as said first portion in said rolling element by disposing magnetic poles with different polarities alternately in a circumferential direction; and

a generating stator provided as said second portion in said non-rolling element, which has an electric coil opposing the magnetic poles of said generating rotor in an radial direction.

14. (Previously Presented) The rolling bearing apparatus according to claim 3, further comprising a radio transmitter for radio-transmitting signals outputted from said rotation detector to a signal processing unit provided outside.

15. (Currently Amended) The rolling bearing apparatus ~~according to claim~~ 14, further comprising :

a rolling element;

Docket No. F-8488

Ser. No. 10/517,895

a non-rolling element disposed concentrically with said rolling element;
a rotation detector for outputting an induced voltage produced by an input
exciting voltage according to a relative rolling state of said rolling element and said
non-rolling element;

said rotation detector comprising:

a rotor provided on said rolling element;
a stator provided on said non-rolling element; and
an exciting winding and output windings wound to
said stator, wherein
said output windings induce a voltage according to
a gap permeance between said rotor and said stator in
response to said exciting voltage inputted to said exciting
winding; and

said stator including a plurality of polar teeth opposing said rolling element,
and said exciting winding and output windings being wound to each of said polar
teeth of said stator.

said rotor comprising a flat portion on a portion of a circumferential surface
of said rolling element which opposes said plurality of polar teeth;

a radio transmitter for radio-transmitting signals outputted from said
rotation detector to a signal processing unit provided outside; and

Docket No. F-8488

Ser. No. 10/517,895

a generator for generating a voltage ~~in accordance with~~ using energy provided by relative rotation of said rolling element and said non-rolling element, and inputting the voltage as an input exciting voltage to said rotation detector while supplying it as a driving voltage to said radio transmitter.

16. (Previously Presented) The rolling bearing apparatus according to claim 3, further comprising a signal processing unit for processing output signals from said rotation detector.

17. (Original) The rolling bearing apparatus according to claim 12, further comprising a signal processing unit for processing output from said generator.

18. (Original) The rolling bearing apparatus according to claim 14, further comprising a signal processing unit for processing output signals from said radio transmitter.

19. (Currently Amended) The rolling bearing apparatus according to claim 3, wherein said rotation detector comprises ~~a rotor provided in said rolling element, a stator provided in said non-rolling element, an exciting winding and output windings wound to said stator, and further comprises a resolver which induces~~ [[a]] the voltage according to a gap permeance between said rotor and said stator in

Docket No. F-8488

Ser. No. 10/517,895

response to an exciting voltage inputted to said exciting winding from said output windings.

20. (Previously Presented) The rolling bearing apparatus according to claim 3, wherein said non-rolling element opposes said rolling element at least in part in a radial direction of the rolling bearing apparatus.

21. (Currently Amended) A rolling bearing apparatus, comprising:

a rolling element including a first raceway wheel;

a non-rolling element disposed concentrically with said rolling element and including a second raceway wheel, said rolling element rolling with respect to said non-rolling element;

a rotation detector providing an induced voltage output produced from an input exciting voltage and influenced according to a gap permeance related to a relative rolling state of said rolling element and said non-rolling element;

a rotor disposed in said rolling element;

a stator disposed in said non-rolling element;

an exciting winding and output windings disposed on said stator, said exciting winding being excited by said exciting voltage and said output winding providing said induced voltage output;

said rotor and said stator being disposed opposing one another in an annular

Docket No. F-8488

Ser. No. 10/517,895

space between said rolling element and said non-rolling element; and

said output windings outputting said ~~induce~~ induced voltage output at a level determined by the gap permeance between said rotor and said stator and by said input exciting voltage.

wherein said rolling element is an inner ring of a bearing and said non-rolling element is an outer ring of the bearing, and said rotor is formed of the inner ring and includes a flat portion of an outer circumferential surface of the inner ring.